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(54) **Low-pressure mercury vapour discharge lamp.**

(57) Low-pressure mercury vapour discharge lamp comprising a tubular discharge vessel arranged within a lamp envelope (1) which discharge vessel consists of two helically bent tube parts (2,3) which are connected together by means of a coupling joint (9), and in which a cool area is formed in the discharge vessel near this coupling joint.

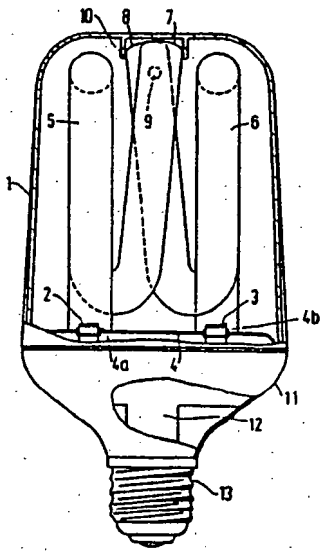

FIG.1

EP 0 231 957 A1

Low-pressure mercury vapour discharge lamp

The invention relates to a low-pressure mercury vapour discharge lamp comprising a tubular discharge vessel, which is arranged within a lamp envelope, which is sealed in a gastight manner, which is filled with mercury and a rare gas and which is curved at a number of areas, electrodes being arranged at the ends of the discharge vessel and being located on the same side of the space within the lamp envelope. A lamp of this type is know from United States Patent 4,383,200.

The known lamp comprises a discharge tube located within the lamp envelope and which is bent into the form of a hook. The lamp has small dimensions and serves as an alternative to an incandescent lamp for general illumination purposes.

The discharge vessel of this lamp is surrounded by the lamp envelope in which the temperature during operation of the lamp easily increases to such a high value that the optimum mercury vapour-pressure for the conversion of supplied energy into ultraviolet resonance radiation of mercury in the discharge vessel (approximately 6×10^{-3} Torr) is exceeded. It is then necessary to take special measures in order to stabilise the mercury vapour-pressure at the said value, for example, by providing a vapour-pressure controlling amalgam in the discharge vessel or by providing the discharge vessel with an appendix which is kept at a relatively low temperature (see USP 4,546,284, PHN 9261). It is, however, complicated to provide such an appendix.

Moreover, the discharge vessel of the known lamp is secured only on one side within the lamp envelope, which makes the lamp vulnerable to vibrations and shocks.

It is an object of the invention to provide a low-pressure mercury vapour discharge lamp of small dimensions and a high efficiency, which does not have the drawbacks of the known lamp.

To this end a low-pressure mercury vapour discharge lamp of the type described in the opening paragraph according to the invention is characterized in that the tubular discharge vessel is

composed of two helically bent tube parts each having an electrode at one end and being sealed in a gastight manner at their other end, said tube parts being connected together by means of coupling joint engaging at some distance form said sealed ends, said coupling joint being located on the side of the lamp envelope remote from the electrodes.

The tubular discharge vessel of the lamp according to the invention has a longer length than the discharge vessel of the know lamp having the same dimensions. The efficiency of the lamp is therefore greater than that of the known lamp.

The helical tube parts are initially formed from, for example, a stretched tube which is provided with a luminescent layer and which is subsequently bent through approximatly 180° at positions one third and two thirds along its length. A stem with an exhaust tube and an electrode is provided at one end in each tube part and the other end is sealed in a gastight manner. Subsequently the two tube parts are connected together near the said sealed ends by means of the coupling joint, the discharge vessel thus formed is exhausted and provided with the mercury and rare gas atmosphere and the exhaust tube is sealed in a gastight manner. A relatively cool space is them obtained between the sealed end itself (thus, where there is no electrode) and the coupling joint engaging at some distance therefrom through which the discharge passes during operation of the lamp. The mercury vapour pressure is then stabilised at the value of 6×10^{-3} torr during operation, whilst the conversion of supplied energy into the said ultraviolet radiation is optimum. This effect is still enhanced because the cool space is located on the side within the lamp envelope remote from electrodes.

In a preferred embodiment of the lamp according to the invention the discharge vessel and the lamp envelope (which preferably consits of a synthetic material) are connected together at an arrea near the sealed ends of the tube parts remote form the electrodes. The discharge vessel is then anchored between two sides facing each other within the lamp envelope. The risk of breakage of the discharge vessel as a result of vibrations and shocks is then smaller than in the known lamp.

In a further embodiment of the lamp according to the invention the wall of the lamp envelope is provided with a recess at the

area of the coupling joint, the bottom part of said recess waving an aperture accomodating the ends of the tube parts, which ends are present within the recess.

In this manner the ends of the tube parts are cooled by the atmosphere surrounding the lamp and the risk of breakage of the ends of the tube parts protruding from the lamp envelope is small.

The lamp according to the invention is compact, and has a high efficiency and a remarkably homogeneous light distribution. Besides the lamp can be manufactured in a relatively simple manner in a bulk manufacturing process.

The invention will be further described with reference to the accompanging drawing.

Figure 1 diagrammatically shows an embodiment of the lamp according to the invention, partly in an elevation, partly in a cross section and

Figure 2 shows part of a further embodiment of the lamp according to the invention.

The lamp of figure 1 comprises a lamp envelope 1 of a transparent synthetic material within which a tubular discharge vessel is arranged which is sealed in a gastnight manner, which is filled with mercury and a rare gas and at the ends of which electrodes 2 and 3 are arranged. The electrodes are located on the same side of the space within the lamp envelope. A synthetic material plate 4 to which the discharge vessel is secured by means of the collars 4a and 4b is provided on this side. The plate is also connected to the lamp envelope 1. The discharge vessel, whose inner wall is provided with a luminescent layer, is composed of two helically bent tube parts 5 and 6. Each of these tube parts supports an electrode at one end and is sealed in a gastight manner at the other ends (7 and 8). At some distance (for example, 1 to 3 times the internal diameter of the tube parts) from these sealed ends the said tube parts are connected together by means of a coupling joint which is diagrammatically denoted by 9. This coupling joint (through which the discharge passes during operation) is formed by fusing collars facing each other and surrounding apertures in the walls of the tube parts.

A method of this type is described in USP 4,324,447 (PHN 9409) and is notably advantageous for joining multiple bent tube parts

because the glass wall of the discharge vessel is only locally heated for the purpose of providing the coupling joint.

The ends 7 and 8 of the tube parts now constitute a relatively cool area in the discharge vessel and are decisive of the magnitude of the mercury vapour pressure in the discharge vessel during operation of the lamp. The said ends 7 and 8 are secured with the aid of a clamping joint in the form of a circular collar 10 forming part of the synthetic material lamp envelope 1. The discharge vessel is now rigidly clamped between the envelope and the synthetic material plate 4.

Each tube part is helically bent. The electrode is incorporated in a gastight manner at the end of a first stretched part. This stretched part is connected to a second stretched part via a U-shaped bent portion. This second part also connects via a further U shaped bent part with a third stretched part which is sealed at its end (for example, at 7).

As is shown in the drawing the longitudinal axes of the two tube parts 5 and 6 constitute an acute angle near the coupling joint. This angle is 10^{0} at a maximum. The collar 10 then forms a reliable clamping joint with the outer wall of the said ends.

Furthermore the lamp is provided with a conical synthetic material lamp tray 11 accommodating an electronic ciruit (diagrammatically shown by 12) for operating and starting the lamp. A circuit of this type is described in the Netherlands Patent Application No. 8400923 laid open to public inspection. Furthermore the lamp has an Edison cap 13 with which it can be screwed into an incandescent lamp holder.

Figure 2 shows a detail of the upper side of a synthetic material lamp envelope of an alternative embodiment of the lamp according to figure 1. The same components as in the lamp according to figure 1 have the same reference numerals. The wall of the lamp envelope is bent inwards to form a recess, an aperture 15 accommodating the ends 7 and 8 of tube parts 5 and 6 being present in the bottom part 14 of the recess. Since the ends 7 and 8 directly communicate with the ambiance of the lamp, the temperature of these ends is relatively low. The recess is formed and dimensioned in such a manner that the cool ends of the tube parts located above the coupling joint 9 do not protrude from the wall of the lamp envelope adjoining the recess.

In a practical embodiment of the lamp according to figure 1 the total length of the tubular discharge vessel (thus the sum of the length of the separate tube parts) is 45 cm. A luminescent layer consisting of a mixture of two phosphors, namely green luminescing yttrium oxide activated with trivalent europium was provided on the inner wall of the discharge vessel (interal diameter approximately 10 mm). The length of the total lamp (measured from the top of the lamp envelope to the end of the cap 13) was 14.5 cm, the maximum width of the lamp was 7.5 cm. The luminous efficiency was 1200 lm for an applied power to the lamp of approximately 20 W (including electronic circuit).

CLAIMS

1. A low-pressure mercury vapour discharge lamp comprising a tubular discharge vessel, which is arranged within a lamp envelope, which is sealed in a gastight manner, which is filled with mercury and a rare gas and which is curved at a number of areas, electrodes being arranged at the ends of the discharge vessel and being located on the same side of the space within the lamp envelope, charcaterized in that the tubular discharge vessel is composed of two helically bent tube parts each having an electrode at one end and being sealed in a gartight manner at their other end, said tube parts being connected together by means of a coupling joint engaging at some distance from said sealed ends, said coupling joint being located on the side of the lamp envelope remote from the electrodes.

2. A low pressure mercury vapour discharge lamp as claimed in Claim 1, characterized in that the coupling joint is formed by fusing collars facing each other and surrounding apertures in the walls of the tube parts.

3. A low pressure mercury vapour discharge lamp as claimed in Claim 1 or 2, characterized in that the lamp envelope is secured to the discharge vessel at an area near the dealed ends of the tube parts remote from the electrodes.

4. A low pressure mercy vapour discharge lamp as claimed in Claim 3, characterized in that the wall of the lamp envelope is provided with a recess at the area of the coupling joint, the bottom part of said recess having an aperture accomodating the ends of the tube parts, which ends are present within the recess.

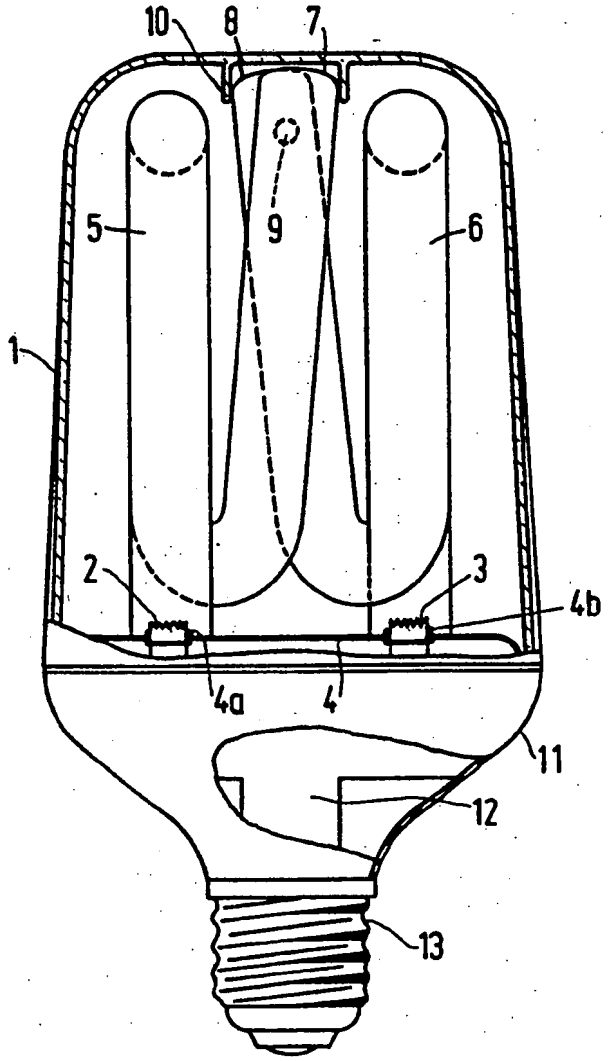

FIG.1

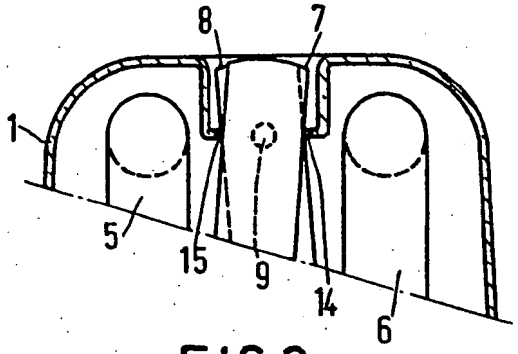

FIG.2

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Application number

EP 87 20 0006

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EUROPEAN SEARCH REPORT

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	WO-A-8 502 712 (SHIN KWANG ENTERPRISE CO., LTD) * Whole document *	1	H 01 J 61/32
A	GB-A-2 065 963 (WESTINGHOUSE ELECTRIC CORP.) * Figures 3,4; page 5, lines 70-111 *	1	
A	PATENT ABSTRACTS OF JAPAN, vol. 5, no. 125 (E-69)[797], 12th August 1981; & JP-A-56 61 758 (MATSUSHITA DENKO K.K.) 27-05-1981	1,3,4	
D,A	FR-A-2 453 495 (PHILIPS) * Whole document *	1,2	TECHNICAL FIELDS SEARCHED (Int Cl 4) H 01 J 61/00

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	31-03-1987	SARNEEL A.P.T.

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